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### STUDIES IN THE HIPPOCASTANACEAE, III A HYBRID SWARM IN THE BUCKEYES

JAMES W. HARDIN

ONE particular population of shrubby buckeyes has caused a great deal of interest among taxonomists and naturalists for a number of years. This population of *Aesculus* is in Georgia, just northeast of Stone Mountain at the northeast edge of De-Kalb County, on U. S. Route 78 (Atlanta to Athens). A large number of specimens, presumably from this population, are preserved in herbaria throughout the United States. One of the earliest of the collections was made in 1869 by Wm. M. Canby, one of the first botanists to visit this area after the Civil War (MeVaugh, 1943). Later collections were made by J. K. Small (in 1891, 1893, 1895), C. S. Sargent (1899 and 1900), A. H. Curtiss (1901), T. G. Harbison (1911, 1912), W. W. Ashe (ca. 1920) and a number of more recent taxonomists. The Stone Mountain area is also of particular interest, in relation to buckeyes, since it is the type locality for *Aesculus georgiana* Sarg. and *A. georgiana* var. *pubescens* Sarg.<sup>1</sup> Also, the type of *A. harbisonii* Sarg. (*A. pavia* × *sylvatica*) was grown at the Arnold Arboretum from seed collected at Stone Mt. by Harbison in 1905.

I was first shown this population in the summer of 1952 by Wilbur H. Duncan who had made general observations on it for some time and who had become interested in the variation. There is no reason to think that this population has changed, significantly at least, since Canby and others visited there.

<sup>1</sup> In the original descriptions, Sargent (1913) cites a collection made by Harbison (No. 907, April 30, 1912) as the type for var. *pubescens*. There is no designation of the type for the species, however he did cite five specimens. Of these five syntypes, Sargent's collection dated April 16, 1900 is hereby designated as the lectotype for this species. Both type specimens are in the Arnold Arboretum Herbarium.

These early collections of Canby, Curtiss, Harbison, etc. show the same variation as the collections made by the writer in 1953.

The shrubs are two to seven feet tall and have a diameter of one half to two inches at the base. They form the dominant low shrub layer beneath a stand of mixed hardwoods and loblolly pine. The community is on the northeast-facing slope of one of the outlying ridges around Stone Mountain. This population of buckeyes covers an area of approximately one acre. The reason for the great attraction of the population is the striking and very apparent variation in a number of characters. The leaves are glabrous to densely tomentose, the shape and size of the inflorescence varies from short and broad to long and narrow, and the flower color particularly has an amazing array of combinations. One extreme in flower color is the red of both calyx and corolla. The other extreme is a pale yellow or often greenish-yellow in both calyx and corolla. Between these extremes one can find a flower to match nearly any shade and with the calyx usually more red than the corolla. The flowers on a single inflorescence are alike except for the variation in the color of the upper-petal claws which are yellow prior to anthesis and brown or orange after anthesis—regardless of general perianth color. Time of flowering also varies. During April when certain shrubs are in bloom, others right next to them are just beginning to blossom or leaf out and showing only the very small, crowded, green buds of the inflorescence.

Random samples of the population were collected on April 8, 1953 (Hardin No. 107). At that time nearly two-thirds of the shrubs in the population were in full bloom. Just over a month later (May 11th) another similar sample was collected (No. 129) at the same spot but from the shrubs then in bloom.

At the time of collection, speculations as to what this variation meant were based merely on general observations. There was no explanation for the variation in pubescence but it was of interest since both extremes were present and formed the basis for Sargent's designation of the two varieties. Also pubescence had been the basis for the distinction between *A. parva* L. and *A. discolor* Pursh. The color variation was of particular interest since *A. parva* of the Coastal Plain is typically red, and *A. sylvatica* Bartr. of the Piedmont is typically yellow.

Could this be a hybrid swarm between these two species? *Aesculus pavia* was certainly not found near here. The long flowering period certainly would include the typical flowering dates of these two species. But, the early-blooming shrubs were not predominately red-flowered. Of course this would not necessarily be expected.

Later, after closer examination of the pressed specimens, it was realized that another "key character" varied. This was the presence of stalked glands on the margin of the petals. *Aesculus pavia* typically has such glands; *A. sylvatica* is villous on the margins. Both conditions were found (but not necessarily with the corresponding perianth colors) and also an intermediate form with both hairs and glands on the margin. Thus it was impossible to identify to either species many of the specimens from this population.

In connection with a monographic study of *Aesculus* by the writer, these population samples have been analyzed using the techniques described by Anderson (1949). Each population sample consisted of 20-50 specimens. Every specimen was measured and scored for the following five characters: calyx length, stamen length, perianth color, pubescence of petal margin, and relationship of stamen length and lateral petal length (i.e., whether the length of the stamen is greater or less than that of the lateral petals). The first two characters are used as the coordinates of the graph, and the other characters are represented by symbols (Fig. 1). The data obtained from the analysis of the Stone Mountain population are presented graphically as pictorialized scatter diagrams in Fig. 1, graphs B and C.

A close examination of the behavior of individual characters in this population (as shown in the scatter diagrams) indicates influence from two directions. Using the method of extrapolated correlates (Anderson, i.e.), one can possibly extrapolate to the two hypothetical introgressants. Identification of these hypothetical species results in the names of *A. pavia* and *A. sylvatica*. As a check of the two suspected introgressing species, population analyses were made for *A. pavia* (Hardin No. 105 from Appling County, Georgia) and for *A. sylvatica* (No. 117 from Clarke County, Georgia). Results of the analyses of these populations

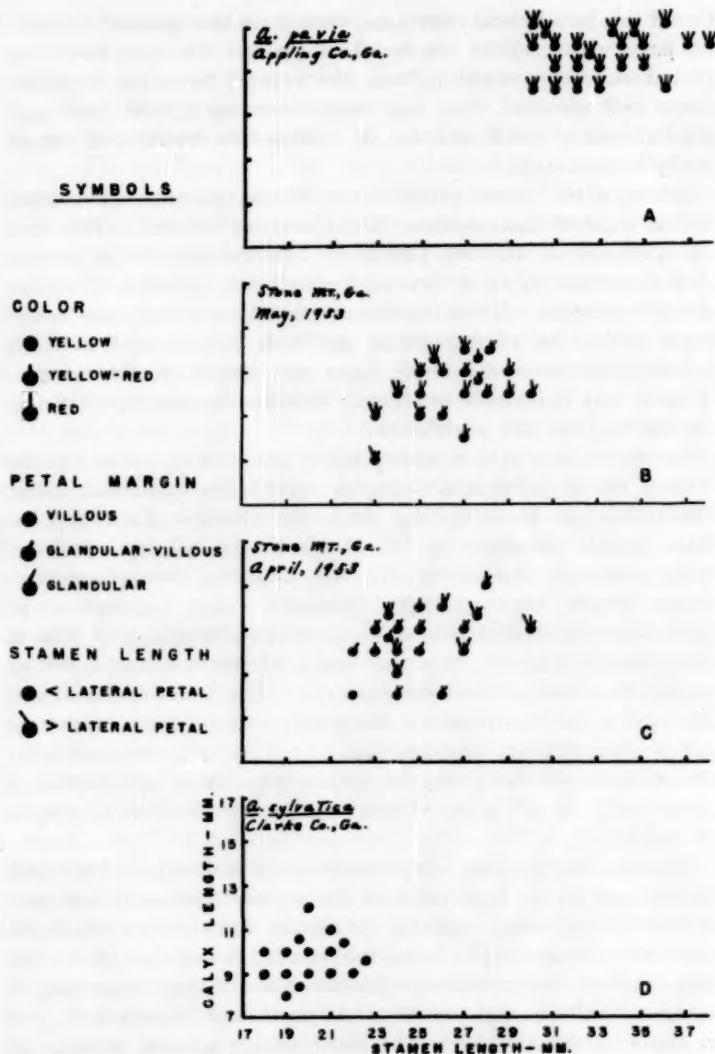


Fig. 1. Pictorialized scatter diagrams of buckeye populations, showing *A. parviflora*, *A. sylatica* and a hybrid swarm at Stone Mountain, Georgia.

are shown in Fig. 1, graphs A and D. It seems obvious from this series of four scatter diagrams that the Stone Mountain population is a hybrid swarm between the suspected *A. pavia* and *A. sylvatica*.

Although every character illustrated has apparently been influenced through hybridization, there is a tendency for the characters of the species to stay together. For example, the red color and the presence of glands on the petal margins are usually closely correlated. With respect to the stamen length vs. calyx length, the entire population is intermediate between the introgressing species. There is, however, relatively little difference between the early- and late-blooming members of the population. If anything, the earlier flowering forms are slightly closer to *A. sylvatica* and more variable. Factors affecting time of flowering appear independent of species differences. Populations of the pure species often show this same variation in time of flowering.

Size and shape of inflorescences seem to be variable in many populations whether hybrid swarms or of pure species. The same variation may even occur on a single shrub (Hardin, 1956). This variation certainly does not seem to be due to hybridization. The variation in pubescence is more or less characteristic of both *A. pavia* and *A. sylvatica*. The variation in this Stone Mountain population is no more extreme than that found in any population of either species. In both species the glabrous form is more often found (at least in eastern populations); however, in nearly every population, slightly tomentose and extremely tomentose leaves are commonly found. These pubescent forms are not recognized by the writer as distinct taxa.

The geographical position of this population is of interest since *A. pavia* is typically found only on the Coastal Plain—some 80–90 miles southeast of Stone Mountain. This hybrid swarm is in the center of the range of *A. sylvatica*. Recent studies of other populations in Georgia and hundreds of herbarium sheets show that *A. pavia*, or at least *A. sylvatica* with a very strong influence of *A. pavia*, extends up the rivers from the Coastal Plain well into the Piedmont. Hybrid populations, for example, are common along the Savannah River far up into northwestern South Carolina. Also the Chattahoochee, Oconee,

Ocmulgee and Yellow Rivers, among others, have served as routes for this apparent gene flow. The population at Stone Mountain is only a few miles west of the Yellow River, so it does not seem too strange to find such a hybrid swarm at this locality in Georgia. It is surprising, however, that *A. pavia* has had such a very strong influence upon *A. sylvatica* even though it is a considerable distance from the typical range and habitat. Does this indicate that *A. pavia* once was regularly on the Piedmont during times when the Coastal Plain was submerged? There is other evidence from which this may be inferred.

Many such hybrid swarms exist throughout the areas of overlap between species ranges. H. K. Svenson (1941) called attention to one such population in Sequatchie Valley of Tennessee. This population has been seen by the writer and is similar in many ways to the one at Stone Mountain. Introgression is often more the rule than the exception in certain areas. Many populations showing introgression between *A. glabra* and *octandra*, *A. octandra* and *sylvatica*, *A. pavia* and *sylvatica*, and to a lesser extent *A. glabra* and *pavia*, have been found. Certainly not all populations in regions of overlap are hybrid swarms, but rather they often show a heightened variation in the parental species. Analyses of these other populations and a more detailed discussion of introgression within the buckeyes will be reported later.

This Stone Mountain population is a graphic illustration of what has been taking place in many localities within and between species populations of the buckeyes of eastern North America. It is also an illustration of why there has been so much confusion in the taxonomy and field identification of these trees and shrubs. To be sure, within this one population at Stone Mountain there are some shrubs which would be placed without question as *A. sylvatica* (e.g., the types of *A. georgiana* and var. *pubescens*). The disturbing fact, though, to the floristic or herbarium systematists and the field naturalists of the Atlanta area, is that the majority of these shrubs at Stone Mountain cannot be "keyed out" in any floristic manual or guide.

A complete understanding of the buckeyes must include

such intermediate forms and the realization that they are of hybrid origin. Likewise, any usable dichotomous key written for the buckeyes of eastern North America should include these hybrid forms in some way.—DEPARTMENT OF BOTANY, UNIVERSITY OF MICHIGAN.

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#### NOTES ON THE CLEISTOGAMOUS SPECIES OF POLYGALA IN SOUTHEASTERN UNITED STATES

CHARLES W. JAMES

In Blake's (1924) monograph of the *Polygalaceae*, two cleistogamous-flowered species of *Polygala* were included for the southeastern United States: the wide-ranging *P. polygama* Walt., known from Florida to Texas and as far north as Minnesota, Ontario, Quebec and Nova Scotia, and *P. lewtonii* Small, an endemic of the sand-scrubs of central Florida. Earlier, Blake (1915) described *P. polygama* forma *obovata*, but later (1924) did not consider it, or any other infraspecific taxon of *P. polygama*, worthy of taxonomic recognition. Subsequently, only one other species, *P. aboriginum* Small (1926), has been described. This is a poorly known "species" from the east coast of Florida (Volusia County).

In the present paper, *P. lewtonii* Small is recognized as a valid species. *P. polygama* Walt. forma *obovata* Blake is elevated to the rank of species and is renamed *P. crenata*. *P. aboriginum* Small is regarded as a synonym of *P. polygama* Walt., as is *P. polygama* Walt. var. *obtusata* Chod. The study is based on specimens from the Florida Agricultural Experiment Station Herbarium (FLAS), the Gray Herbarium (GH) and the New York

Botanical Garden (NY). The assistance of the curators of these institutions is kindly acknowledged.

Seeds are set in both cleistogamous and normal flowers in each of the three species. Whether or not the production of seeds in the cleistogamous flowers is advantageous to survival or has contributed to the evolution of these species is not known. *P. lewtonii* and *P. crenata* exhibit very little variation, providing little reason to believe that local segregates are being produced or maintained through cleistogamy. However, this does not eliminate the possibility that these two species may themselves have evolved as such segregates from *P. polygama*. The latter species presents considerable variation (in length of racemes, and in the size of floral parts and seeds), although this is to be expected to some degree because it occupies so many ecologically different regions.

The duration of these plants has been a point of question. *P. polygama* and *P. lewtonii* have been described as biennials and biennials (or annuals?), respectively. In this study, plants of all three species from many localities were observed to have remnants of previous flowering shoots which indicate that they are perennials. Southward, the shoots frequently appear to persist throughout the winter, giving rise to new ones the following spring.

The seeds and capsules are of considerable importance in the classification of members of the genus. These structures furnish the only known diagnostic features within this species group.

#### KEY TO THE SPECIES

Capsules oblong, twice as long as wide; seeds cylindric, the upper part of the arils bony like the caruncle.....1. *P. lewtonii*.  
Capsules oval, less than twice as long as wide; seeds ovoid to cylindric-ovoid, the arils membranaceous throughout.  
Margin of capsule with narrow, thin, crenate wing; caruncle with flexible hairs longer than those on the body of seed, the arils connivent.....2. *P. crenata*.  
Margin of capsule merely ridged, entire (rarely wing-like); caruncle with short, straight, bristly hairs, no longer than those on body of seed, the arils usually divergent.....3. *P. polygama*.

1. *Polygala lewtonii* Small, Bull. Torr. Bot. Club 24: 140. 1898.  
TYPE: Frostproof, Polk Co., Florida, Lewton, 19 March 1894 (NY). HABITAT AND DISTRIBUTION: sand-scrub areas of central Florida.—HIGH-

LANDS Co.: e. of Sebring, *Garrett 140* (FLAS); e. of Sebring, *Small 9574* (NY); e. of Sebring, *Small 11145* (FLAS, GH, NY). LAKE Co.: near Eustis, Hunnewell 8689 (GH). MARION Co.: Ocala National Forest, *Mather*, 30 March 1949 (FLAS). ORANGE Co.: Table-top Hill, nw. of West Apopka, *Harper 15* (GH, NY). POLK Co.: Lake Wales, *King*, 28 Dec. 1948 (FLAS); Lake Davenport, *McFarlin*, 3 April 1928 (FLAS); Crooked Lake, *McFarlin*, 1925 (FLAS); Loughman, *West*, 8 May 1928 (FLAS).

Although the Highlands and Marion County citations represent an extension of range, *P. lewtonii* is nevertheless known only from the sand pine-scrub type of community. This species appears to be a true endemic of the region and not merely an ecological variant of *P. polygama*. Such a belief is substantiated not only by the strong morphological features of the seeds and capsules, but by the fact that typical *P. polygama* has been collected from this same kind of habitat (*Brass 14703*, Highlands Co., Fla., GH), and the diagnostic features have remained distinctive. However, the extent to which *P. polygama* occurs within the habitat and range of *P. lewtonii* cannot be satisfactorily determined from the available collections and their data. It is known that *P. polygama* occurs in Lake and Orange Counties, also within the range of *P. lewtonii*, but in a quite different habitat (low, wet pine lands), unusual for this species.

2. **Polygala crenata** James, nom. et stat. nov.<sup>2</sup> Based on *Polygala polygama* Walt. forma *obovata* Blake, *RHODORA* 17: 201. 1915. TYPE: New Orleans, Orleans Parish, Louisiana, *Drummond 38*, 1832 (BM). Isotype examined (GH). PARATYPE: swampy places between Tallahassee and St. Marks, Florida, *Rugel 106*, April-May 1843 (BM). Leaves from paratype examined (GH).

Stems erect, typically simple, solitary to many from a perennial root, (1.2)-2-3(-3.5) dm. high, glabrous, bearing racemes of cleistogamous flowers at the base or from the axils of the leaves; leaves glabrous, alternate, those of older shoots obovate, 1-2(-2.3) cm. long, 3-8 mm. wide, leaves of the flowering shoots smaller, obovate to elliptic, (0.5)-0.8-1.3 (-1.7) cm. long, (2)-3-5(-9) mm. wide, the bases cuneate, the apices rounded, obtuse or the upper leaves even acute, sometimes cuspidulate; racemes pyramidal, becoming cylindric, 1-1.5 cm. thick, the axis becoming 7-10(-15) cm. long, peduncles 1-2(-2.5) cm. long; bracts ovate, glabrous, deciduous, ca. 1 mm. long; pedicels becoming 3-4 mm. long; flowers light to deep pink; sepals oval to ovate, acute or obtuse, ca. 1.3-2 mm. long, glabrous; wings 4-5 mm. long, clawed at base, the blade orbicular to oval or oval-obovate, glabrous; keel 3-4 mm. long; capsule

<sup>1</sup> *Pinus clausa*.

<sup>2</sup> Neither "obovata" nor "blakeana" is available as a specific epithet.

oval, 2-2.5 mm. long and about as wide at base, apex notched, the margin narrowly winged, the wing crenate; seeds 2, ca. 2 mm. long, mostly less than 1 mm. wide, ellipsoid-ovate, but sharp pointed at base, pilose, the hairs appressed, caruncle cylindrical, bearing relatively long (some over 0.5 mm.) flexible hairs at apex, arils oval, connivent, cellular, appressed to seed, nearly 1 mm. long, less than half the length of seed.

HABITAT AND DISTRIBUTION: low pine barrens of the Gulf Coast, from northwestern Florida into Louisiana.—**Florida.** BAY CO.: Lynn Haven, *Banker* 3518 (NY); Lynn Haven, *Knight*, 21 May 1940 (FLAS); Calloway, *Hood* 1685 (FLAS). CALHOUN CO.: 1 mi. n. of Blountstown, *Hood* 1567 (FLAS). DIXIE CO.: sw. of Cross City, *Baker*, 21 April 1939 (FLAS). FRANKLIN CO.: Apalachicola prairies, *Small* 11254 (FLAS, NY). GULF CO.: s. of Dalkeith, *Moldenke* 1149a (NY); n. of the Apalachicola-Panama Canal, *Small* 11238 (NY). JACKSON CO.: near Sneads, *Harper* 78 (GH, NY); Cypress, *Knight*, 22 April 1941 (FLAS). LEON CO.: 10 mi. s. of Tallahassee, *Palmer* 38489 (GH). WASHINGTON CO.: near Brock, *Hood* 1960 (FLAS). **Mississippi.** HARRISON CO.: Biloxi, *Tracy* 5181 (NY). JACKSON CO.: Ocean Springs, *Demaree* 28659 (Gulf Coast Research Laboratory, Ocean Springs, Miss.); Kreole, *Demaree* 34884 (GH); Ocean Springs, *Demaree* 35053 (GH); n. of Cicoria's, *Diener* 10 (Gulf Coast Research Laboratory). **Louisiana.** ORLEANS PARISH: New Orleans, *Ingalls* (NY).

Since *P. polygama* Walt. forma *ovata* Blake was based primarily on leaf-shape, it is not surprising that plants in various sections of the range of *P. polygama* have been identified as this form. Plants with obovate leaves are common in at least three areas: the Gulf Coast (including the specimens upon which forma *ovata* was based); Arkansas and Oklahoma; and the mountainous parts of Georgia, South Carolina, North Carolina, Virginia, and Maryland. Whether or not the plants of the latter two areas deserve taxonomic recognition is not clear. This could not be determined from the mostly immature specimens at hand. However, the plants of the Gulf Coast (*P. crenata*) differ significantly from *P. polygama* in features other than mere leaf shape. They are typically smaller, erect, sparsely if at all branched, and have shorter leaves. The capsules are clearly winged, and the wings are conspicuously crenate. The seeds are smaller, with a straight caruncle bearing long, flexible hairs. In addition, *P. crenata* seems to be a species of the low, frequently wet, acid pine barrens, whereas *P. polygama* is usually found in drier, well-drained sites. Most of the specimens examined from the Gulf Coast are *P. crenata*, but the range of *P. polygama* also includes parts of this area. Although

Nash's collection (204, Lake Co., Fla.) of *P. polygama* somewhat resembles *P. crenata* in vegetative characters, no specimen was seen which could be classed as an intermediate between these two species.

3. ***Polygala polygama*** Walt. Fl. Carol. 179. 1788. (No specimen of this taxon is present in the Walter Herbarium.) *P. polygama* Walt. var. *obtusata* Chod. Mém. Soc. Phys. Genève 31 (2)<sup>2</sup>: 280. 1893. *P. polygama* Walt. var. *abortiva* Chod. l. c. *P. polygama* Walt. forma *albiflora* House, Bull. N. Y. State Mus. 45: 243. 1923. *P. aboriginum* Small, Torreya 26: 92. 1926. TYPE: "Hammock, Turtle Mound," Volusia Co., Fla., Small, 24 May 1926 (ny). *P. polygama* Walt. var. *ramulosa* Farwell, Am. Mid. Nat. 11: 63. 1928.

After Blake (1924) relegated var. *obtusata* to the synonymy of *P. polygama*, Fernald (1940) apparently was the first to reinstate it. However, I have been unable to correlate the morphological features upon which this variety was described with any geographical area and, therefore, it is left in the synonymy of *P. polygama*. The character upon which Fernald heavily relied in distinguishing it was the relatively condensed inflorescence. This, in general, characterizes the plants from the northernmost states and Canada, but southward the racemes may or may not be condensed, even in the same population. Temperature alone could be the limiting factor in the elongation of the inflorescence in the northern plants, whereas in the southern plants it could be a reflection of one or several other critical environmental conditions.

Variety *abortiva* was shown by Robinson (1900) to be the autumnal form of typical *P. polygama*. The same phase has also been described as var. *ramulosa*. This growth form is characterized by recurved racemes of cleistogamous flowers which are borne in upper leaf axils rather than near the base of the plant.

Small distinguished *P. aboriginum* from *P. polygama* chiefly on the relatively short pedicels and wings, quantitative characters which vary considerably in this complex. A series of specimens collected by Weber (near Fairbanks, Alachua Co., Fla., 22 April 1928, FLAS), demonstrates very well the sporadic occurrence of the reduced wings in a single population. Since this taxon is neither a strongly differentiated morphological unit, nor a geographical segregate within the species, it seems

that the rank of forma would be sufficient for it if a formal taxonomic category were shown to be desirable. GRAY HERBARIUM, HARVARD UNIVERSITY.

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#### REVIEW OF THE GENUS CLADONIA IN THE DISTRICT OF COLUMBIA AND VICINITY

S. F. BLAKE

IN 1931 the late Charles A. Robbins and the writer published<sup>1</sup> an annotated, keyed list of the species of reindeer-moss and related forms then known from the District of Columbia region, a circle of approximately 15 miles radius about the Capitol in Washington, thus including areas in adjacent Maryland (in Montgomery and Prince Georges Counties) and Virginia (Arlington and part of Alexandria and Fairfax Counties). In those days specific distinctions in *Cladonia* were founded mostly on morphological characters with frequent assistance from the color changes brought about by treatment with caustic potash, in some cases supplemented by chloride of lime. Since that time more and more diagnostic importance has come to be attributed to the chemical constituents of the species of *Cladonia*, determined in some cases by the color changes induced by the application of new chemicals, particularly paraphenylenediamine, in others by the shape and color of the microcrystals formed by the evaporation of a solution obtained by extracting dried material of *Cladonia* with acetone or chloroform, then treating with a mixture of glycerine and glacial acetic acid or some similar compound.

<sup>1</sup> *Cladonia in the District of Columbia and vicinity.* *RHODORA* 33: 145-159. pl. 210-212. 1931.

In recent years the leader in the chemical investigation of species of *Cladonia* as well as other lichens has been the Japanese botanist Yasuhiko Asahina. In this country Dr. Alexander W. Evans, for a full quarter-century the leading American student of the genus, has contributed a long series of critical papers and several state *Cladonia* floras based on the most careful study of very extensive collections, in which full consideration has been given to the chemical and microcrystalline characters of the species investigated. All the critical material on which the present paper is based has been named by Dr. Evans and his identifications have been followed throughout, although a phanerogamic botanist can hardly avoid having reservations regarding the specific distinctness of forms distinguished essentially by chemical reactions alone.

Since the 1931 paper was published extensive collections of *Cladonia* have been made by Emery C. Leonard of the U. S. National Herbarium in the District of Columbia region, particularly on Plummers Island, Montgomery County, Maryland,<sup>2</sup> and at a locality, the Patuxent Research Refuge, about 5 miles southeast of Laurel, Prince Georges Co., Maryland, 6 miles east of Beltsville, and approximately 17 miles northeast of the Capitol and so slightly outside the limits adopted in the earlier paper; and some earlier collections by him have been examined. Records from the last-named locality, including two species not at present known elsewhere in the region, have been included in the present list. A few additional specimens have been collected in the region by the writer. All of Mr. Leonard's and my own specimens here recorded, as well as numerous older specimens belonging to critical species, have been identified by Dr. Evans, to whom my best thanks are due for continual assistance of this sort during the past twenty-five years. My whole *Cladonia* herbarium has been deposited in the National Fungus Collections at Beltsville, Md.

Records not given in the 1931 list are distinguished by the addition of the collector's name and date, except that when, as in the case of *C. caroliniana* and *C. grayi*, a specific name has been changed and new infraspecific categories appear, no details are given for them if they are based on material already recorded

<sup>2</sup> E. C. LEONARD AND E. P. KILLIP, Natural History of Plummers Island, Maryland. VIII. Lichens. Proc. Biol. Soc. Washington 52: 23-26. 1939. (Cladoniaceae, p. 25.)

in the 1931 list. Localities are repeated from the earlier list for all species known from not more than three or four localities. The locality "in vicinity of Landover near Bladensburg, Maryland," at which I collected in the '20's several rarities, one of which (*C. floerkeana*) was and still is known from no other spot in the region, has now been obliterated by building operations.

The original list included 36 species, raised to 38 in the present catalog. Four species have been omitted as wrongly identified (*C. coccifera*, *C. impexa*, *C. mitis*, and *C. polycarpia*), six have been added (*C. cryptochlorophaea*, *C. conista*, *C. didyma*, *C. grayi*, and *C. submittis*, as well as *C. atlantica* which is equivalent to some of the named forms of *C. squamosa* in the earlier list), and the names of six have been changed. Two of the additional species are segregates of *C. chlorophaea* and a third (*C. conista*) is intermediate between that species and *C. fimbriata*.

1. ***Cladonia rangiferina* (L.) Web.** Rare and local; near Prospect Hill, Fairfax Co., Va.; near Lanham, and at Burnt Mills, Md. In addition to the typical form, f. *crispata* Coem. has been collected.

2. ***C. sylvatica* (L.) Hoffm.** Scarce; recorded in 1931 from near Landover, near Lanham, at Burnt Mills, and Suitland bog, Md., and near Mt. Vernon, Va., and since collected at Patuxent Research Refuge, near Laurel, Md., by Leonard. In addition to the typical form, f. *pygmaea* Sandst. and f. *sphagnoides* (Floerke) Oliv. have been collected.

3. ***C. subtenuis* Des Abbayes.** (*C. tenuis* (Floerke) Harm. and *C. impexa* Harm. of 1931 list.) Abundant. Forms *condensata* (Floerke) Sandst. and f. *laxiuscula* (Del.) Sandst. of *C. impexa*, recorded in the 1931 list, can be expunged, and the following named form added: *C. subtenuis* f. *cinerascens* (Des Abbayes) Evans: on rocks, near Prospect Hill, Fairfax Co., Va., 1925, Blake; sandy pine woods, vicinity of Hyattsville, Md., 1924, Blake.

[*C. mitis* Sandst. The single collection on which the 1931 record was based, from near Great Falls, Va., has been examined by Dr. Evans; the specimen is P +, and thus not *C. mitis* as now understood, but it is in too fragmentary condition to be identified. The species should be expunged from the list.]

4. ***C. submittis* Evans.** Along fence rows, lower end of Patuxent Research Refuge, near Laurel, Md., 1946, Leonard 21871 and 21872 C.

5. ***C. papillaria* (Ehrh.) Hoffm.** Fairly common. Represented by four forms: f. *molariformis* (Hoffm.) Schaer, f. *papillosa* Fr., f. *prolifera* (Wallr.) Schaer (this from Patuxent Research Refuge near Laurel, Md., 1956, Leonard & Hotchkiss 22351), and f. *stipata* Floerke.

6. ***C. vulcanica* Zolling. f. *minor* Robbins.** Rare: Arlington, Va., Prospect Hill, Fairfax Co., Va., Riggs Mills near College Park, Md., and "District of Columbia."

7. ***C. didyma* (Fée) Wain.** On rotten log in woods, northwest of the buildings, Patuxent Research Refuge, near Laurel, Md., 1946, Leonard 21736.

8. ***C. floerkeana* (Fr.) Floerke var. *intermedia* Hepp.** At a single

locality in vicinity of Landover, near Bladensburg, Md., now destroyed by building operations.

9. **C. bacillaris** (Ach.) Nyl. Common. Most of the material collected is referable to *f. clavata* (Ach.) Wain.

10. **C. macilenta** Hoffm. f. *styraecella* (Ach.) Wain. Rare.

[*C. coccifera* (L.) Willd. Recorded in the 1931 list from a single locality in vicinity of Landover, near Bladensburg, where represented by var. *stemmatina* (Ach.) Wain. and var. *phylloloma* Floerke. Both collections now referred by Dr. Evans to *C. pleurota*; the specimen called var. *phylloloma* enters var. *frondescens* of that species.]

11. **C. pleurota** (Floerke) Schaer. Not common. In addition to the typical form, the following three forms occur: var. *cerina* (Nagel) Th. Fr., *f. decorata* (Wain.) Evans, and var. *frondescens* (Nyl.) Oliv.

12. **C. cristatella** Tuck. Abundant. Represented by the following forms: *f. beauvoisii* (Del.) Wain., *f. ochrocarpia* Tuck., *f. squamulosa* Robbins, and *f. vestita* Tuck., of the 1931 list; and in addition *f. pleurocarpa* Robbins (Patuxent Research Refuge, near Laurel, Md., 1946, *Leonard* 21599 in part) and *f. ramosa* Robbins (clayey soil near edge of pine woods, Battery Park near Bethesda, Md., 1925, *Blake*).

13. **C. incrassata** Floerke. (*C. paludicola* (Tuck.) Merrill of 1931 list.) Rare; Arlington, Va., and vicinity of Landover, near Bladensburg, Md.; also Franklin Park near McLean, Va., 1931, *Leonard* 15926 b. Forma *squamulosa* (Robbins) Evans has been collected at Franklin Park, near McLean, 1932, *Leonard* 16214.

14. **C. uncialis** (L.) Web. Fairly common. The following named forms have been collected: *f. dicraea* (Ach.) Wain., *f. humilior* Fr. (this from Prospect Hill, Fairfax Co., Va., 1925, *Blake*), *f. obtusata* (Ach.) Nyl., and *f. subobtusata* Arn.

15. **C. caroliniana** (Schwein.) Tuck. (*C. boryi* Tuck. of 1931 list.) Rare; Upton Hill, Arlington Co., Va.; vicinity of Landover, near Bladensburg, Md.; and southeast of Decatur Heights, Bladensburg, 1931, *Leonard* 15949. The material includes specimens referred by Dr. Evans to the following forms: *f. dilatata* Evans, *f. fibrillosa* Evans, and *f. prolifera* Evans; also *f. tenuiramea* Evans (Patuxent Refuge near Laurel, Md., 1956, *Leonard* 22338, 22341a, 22352).

16. **C. floridana** Wain. Known from only two localities, one (now destroyed) in vicinity of Landover, near Bladensburg, Md., where common, the other near Lanham, Md. The following forms occur beside the typical form: *f. brachiata* Robbins, *f. elegans* Robbins, *f. esquamosa* Robbins.

17. **C. delicata** (Ehrh.) Floerke f. *quercina* (Pers.) Wain. Fairly common.

18. **C. fureata** (Huds.) Schrad. Fairly common. The following varieties and forms occur: var. *pinnata* (Floerke) Wain. f. *foliolosa* (Del.) Wain., var. *pinnata* f. *turgida* (Seriba) Sandst. (Plummers Island, Md., 1936, *Leonard* 2606 and 2607), var. *racemosa* (Hoffm.) Floerke, var. *racemosa* f. *squamulifera* Sandst. (Plummers Island, 1931-42, numerous collections by Leonard and others), var. *racemosa* f. *subclausa* (Sandst.) Evans.

19. **C. squamosa** (Scop.) Hoffm. Common. The following forms occur: *f. denticollis* (Hoffm.) Floerke, *f. levicorticata* (Sandst.) Evans (Patuxent Research Refuge near Laurel, Md., 1956, *Leonard* & *Hotchkiss* 22382), *f. phyllocoma* (Rabenh.) Wain., *f. sessilis* Robbins, *f. squamosissima* Floerke.

20. **C. atlantica** Evans. (*C. squamosa* f. *levicorticata* m. *rigida* and m. *pseudocrispata* and f. *turfacea* of 1931 list). Fairly common. In addition

to the typical form, *f. ramosa* Evans and *f. subsimplex* Evans (the latter from Patuxent Research Refuge near Laurel, Md., 1946, *Leonard 21832*) have been identified.

21. *C. caespiticia* (Pers.) Floerke. Fairly common.
22. *C. apodocarpa* Robbins. Rather common.
23. *C. capitata* (Michx.) Spreng. *f. imbricatula* (Tuck.) Evans. (*C. mitrula* of 1931 list.) Very common.
24. *C. subcariosa* Nyl. Very common. To the forms reported in 1931, *f. epiphylla* Robbins, *f. evoluta* Wain., *f. pallida* Robbins, and *f. squamulosa* Robbins, should be added *f. ramosa* Dix (Beltsville, Md., 1949, *Blake*).
- [*C. polycarpa* Merrill. To be deleted. The single scanty collection from Great Falls, Va., on which the 1931 record was based is indeterminable, but is not *C. polycarpa*, *C. subcariosa*, or *C. clavulifera*.]
25. *C. clavulifera* Wain. Rather scarce. In addition to the typical form (which has been named *f. nudicaulis* Evans), and *f. subvestita* Robbins, *f. pleurocarpa* Robbins has been recorded (Plummers Island, Md., 1933, *Leonard 2223*).
26. *C. brevis* Sandst. (*C. alpicola* var. *karelica* of 1931 list.) Known only from a single somewhat unsatisfactory record, that of two specimens collected by Lehnert in "District of Columbia" and mounted with others of *C. capitata* and *C. subcariosa*. Dr. Evans informs me that he has southern material from Virginia, West Virginia, and North Carolina; all his Virginia specimens come from counties in the mountains except for one from King and Queen County in Tidewater Virginia.
27. *C. pyxidata* (L.) Fr. Scarce. Represented by two named forms, *f. lophyra* (Ach.) Rabenh. and *f. simplex* (Ach.) Harm., both belonging under var. *neglecta* (Floerke) Mass.
28. *C. chlorophaea* (Floerke) Spreng. Although reported in the 1931 list as the commonest and most variable *Cladonia* in the region, *C. chlorophaea* as now restricted by the excision of *C. grayi* turns out to be extremely scarce. All my own specimens, referred to 9 named forms by Robbins, prove to belong to *C. grayi*, a morphologically almost identical species which he did not distinguish from *C. chlorophaea*. The only specimens from the region which Dr. Evans finds referable to *C. chlorophaea* (*f. simplex* (Hoffm.) Arn.) are the following: Near Saegmiller's place, Alexandria Co., Va., 1917, *Mary F. Miller* (locality dubious, perhaps in Arlington Co.); between Anacostia and Twining City, D. C., 1918, *Leonard 134 p. p.*
29. *C. grayi* Merrill. Abundant, practically all the material on which the 1931 listing of *C. chlorophaea* was based now being referred to this species, which scarcely differs except in chemical reaction. In addition to the typical form, Evans identifies the following: *f. carpophora* Evans, *f. cyathiformis* Sandst., *f. squamulosa* Sandst. The species was first recorded by Leonard and Killip in their Plummers Island list.
30. *C. cryptochlorophaea* Asahina. Sligo Creek, Montgomery Co., Md., 1918, *Leonard 62 p. p.*; Plummers Island, Montgomery Co., 1938, *Leonard 2759*.
31. *C. conista* (Ach.) Robbins *f. simplex* Robbins. Sligo Creek, Montgomery Co., Md., 1918, *Leonard 62 p. p.*; vicinity of Great Falls, Va., 1924, *Killip 12447*.
32. *C. coniocraea* (Floerke) Sandst. Fairly common. Three forms occur: *f. ceratodes* (Floerke) Wain., *f. phyllostrota* (Floerke) Wain., *f. truncata* (Floerke) Wain.

33. *C. pityrea* (Floerke) Fr. Scarce; Plummers Island, Md., near Chevy Chase, Md., and near Great Falls, Va. Two forms are known: *f. hololepis* (Floerke) Wain. and *f. subacuta* Wain., both belonging under var. *zwackhii* Wain.

34. *C. mateocyatha* Robbins. Scarce. Besides the typical form, *f. squamulata* Robbins has been collected.

35. *C. verticillata* (Hoffm.) Schaeer. Fairly common; the following forms occur: *f. apoticta* (Ach.) Wain., *f. evoluta* (Th. Fr.) Stein, *f. phyllocephala* (Flot.) Oliv., and *f. phyllophora* (Ehrh.) Flot. (the last from Plummers Island, Md. 1907, *B. Fink* 103 in part).

36. *C. robbinsii* Evans. (*C. foliacea* var. *alcicornis* of 1931 list.) Known only from rocks at Great Falls, in both Maryland and Virginia.

37. *C. strepsilis* (Ach.) Wain. Common. Three forms have been collected: *f. coralloidea* (Ach.) Wain., *f. glabrata* Wain., *f. subsessilis* (Wain.) S andst.

38. *C. piedmontensis* Merrill. Common. The following forms occur: *f. lepidifera* (Wain.) Robbins, *f. obconica* Robbins, *f. phyllocoma* Robbins, *f. squamulosa* Robbins.—HORTICULTURAL CROPS RESEARCH BRANCH, AGRICULTURAL RESEARCH SERVICE, U. S. DEPARTMENT OF AGRICULTURE, BELTSVILLE, MARYLAND.

## MISCELLANEOUS CRUCIFERAЕ OF MEXICO AND WESTERN TEXAS

REED C. ROLLINS

Most taxonomists recognize the fact that the flora of certain areas of Mexico and adjacent United States is very inadequately known, but there is only a limited opportunity to help with the task of doing something about it. The lack of study collections is the primary source of difficulty. For several years I have known about a number of new species in the Cruciferae from the area, but I have refrained from describing them because of inadequate material. Now, with more material at my disposal, a small group of these has received attention again, and they are described below.

### *Thelypodium Paysonii* Rollins, sp. nov.

Herbaceous annual or biennial; basal leaves not present; stems branched, densely hirsute with long spreading simple trichomes, 2-4 dm. long; cauline leaves petiolate, pinnate, with the lobes dentate, 3-6 cm. long, 1-3 cm. wide, pilose along petiole and main vein, lobes mostly glabrous, narrowly oblong, markedly dentate; pedicels slender, glabrous, divaricately ascending in flower, spreading at right angles to rachis and slightly curved downward in fruit, 6-9 mm. long; buds broadly clavate; sepals whitish, glabrous, non-saccate, oblong, 3-4 mm. long; petals white, with a long claw, blade spatulate, 1-1.5 mm. across, petals 5-6 mm. long,

spreading at anthesis, claw very slender, expanded toward base, pubescent with glandular trichomes below; stamens exerted, spreading at anthesis, nearly equal, 6-7 mm. long, filaments slightly expanded toward base, pubescent with glandular trichomes below; siliques straight to slightly curved, divaricately ascending when young, widely spreading and pendulous at maturity, stipitate, thickish, only slightly flattened parallel to septum, glabrous, 4-6 cm. long, 1.5-2 mm. wide; valves with a central nerve extending full length, secondary nerves forming a network and less prominent; gynophore 0.5-2 mm. long; styles slender, 1.5-2 mm. long, unexpanded at apex; seeds wingless, immature. Fig. 1, A-C.

Herba annua vel biennis; caulibus ramosis hirsutis; foliis radicalibus ignotis; foliis caulinis petiolatis, sparse pilosis pinnatis, 3-6 cm. longis, 1-3 cm. latis, pedicellis floriferis divaricatis, pedicellis fructiferis patentibus; sepalis albidis glabris nonsaccatis patentibus oblongis 3-4 mm. longis; petalis albis patentibus spathulatis 1-1.5 mm. latis, 5-6 mm. longis; siliquis stipitatis linearibus patentibus glabris, subteretibus 4-6 cm. longis, 1.5-2 mm. latis, stylis tenuissimis 1.5-2 mm. longis; seminibus immaturis exalatis.

Type in the Gray Herbarium collected in Cañon de Jara, east of Socorro; lower part of canyon near its mouth, about 30 km. west of Cuatro Cienegas, Coahuila, Mexico, Feb. 1-15, 1941, *Albert H. Schroeder* 12. Additional specimens examined: rocky soil, Torreón, Coahuila, 1903, *C. A. Purpus* 130 (GH); Sierra de Parras, Coahuila, March, 1905, *C. A. Purpus* 1028 in part (GH).

The Purpus specimen from Torreón was early identified by T. S. Brandegee as *Cardamine*, but when I first encountered it some years ago, I was sure it did not belong in that genus. No flowers are present on the specimen, but the stipitate siliques suggested *Thelypodium* or a nearly related genus. Payson recognized the single plant of *Purpus* 1028, mounted with *Sibara Viereckii* var. *Endlichii* on a single sheet, as a new species, but failed to describe it. The Schroeder specimen is complete except for the basal portion and shows that the species is definitely related to *Thelypodium texanum*. Both of these species and *T. tenui*, described below, have pinnately lobed leaves, contrasting in that respect with *T. Wrightii* of the same species-group, which has entire or dentate leaves. The siliques of *T. texanum* are ascending, whereas they are widely spreading to pendant in *T. Paysonii*. The new species has densely pilose or hirsute stems with similar trichomes extending to the petioles and main veins of the leaves while plants of *T. texanum* are completely glabrous. In *T. Paysonii*, the styles are very slender and the lower portions of the petals and filaments are well



FIG. 1. *Thelypodium Paysonii* Rollins. A—habit  $\times \frac{1}{2}$ . B—flower  $\times 6$ . C—silique  $\times 1$ . Drawings from the type by B. Tugendhat.

covered with glands. In *T. texanum*, the styles are stouter and glands are nearly if not completely absent from the petals and stamens. The inflorescence of the latter species is very dense, with crowded stout pedicels and numerous flowers, while in *T. Paysonii*, the inflorescences are lax, with relatively few flowers and slender pedicels. This is shown in Fig. 1.

***Thelypodium tenue* Rollins, sp. nov.**

Herbaceous annual; stems single from base, branched, glabrous and glaucous, over 3 dm. high; basal leaves pinnately lobed, petiolate, thickish, glabrous and glaucous, 1-2 dm. long, 2-4 cm. wide, more or less obtuse at apex, lobes irregularly dentate, broadly oblong, remote and narrower on lower part of leaf, decurrent on rachis, petioles striate, expanded at base; caudine leaves reduced upwards, nearly pectinate, glabrous, glaucous; inflorescence elongated, dense; pedicels very slender, divaricately ascending, glabrous, 2-3 cm. long; sepals greenish to slightly tinged with purple, non-saccate, oblong, 4-5 mm. long, ca. 1.5 mm. wide, spreading at anthesis; petals white, narrowly spatulate with a very narrow claw, 7-8 mm. long, 1.5-2 mm. wide, spreading at anthesis; stamens exserted, spreading at anthesis; filaments nearly equal, 7-8 mm. long, slightly dilated at base, subtended by a continuous mold of glandular tissue which is well developed beneath single filaments; anthers purplish, ca. 2.5 mm. long; young siliques erect, terete, glabrous, borne on a short stipe less than 1 mm. long; styles tapering toward apex, less than 1 mm. long; stigma circular, reduced in diameter than the end of the style.

Herba annua; caulis crassis ramosis glabris et glaucis > 3 dm. altis; foliis radicibus crassis petiolatis pinnatilobatis glabris et glaucis 1-2 dm. longis, 2-4 cm. latis, lobis dentatis; foliis caulinis pinnatilobatis vel pectinatis; pedicellis tenuibus divaricato-ascendentibus glabris 2-3 cm. longis; sepalis oblongis nonsaccatis patentibus 4-5 mm. longis, ca. 1.5 mm. latis; petalis anguste spatulatis albis patentibus 7-8 mm. longis, 1.5-2 mm. latis; staminibus exsertis; siliquis immaturis stipitatis subteretibus; stylis tenuibus < 1 mm. longis.

Type in the Gray Herbarium collected in the bed of Fresno Creek, about 1 mile below Smith Mine, Presidio Co., Texas, Jan. 25, 1942, L. C. Hinckley 2336.

*Thelypodium tenue* is the fourth species belonging to the group of which *T. Wrightii* was the only known member for many years. As previously indicated<sup>1</sup> *T. Wrightii* has been segregated as a genus distinct from *Thelypodium* and called *Stanleyella Wrightii*. However, I cannot find adequate grounds for making such a separation. The essential unity and inter-

<sup>1</sup> Contrib. Dudley Herb. 3: 371. 1946.

relationship of *T. Wrightii* with the rest of *Thelypodium* is further pointed up by the characteristics of *T. tenue*. The latter species is most nearly related to *T. texanum* and *T. Paysonii*, but it does have very slender pedicels similar in diameter to those of *T. Wrightii* but much longer and more ascending. *T. tenue* has much better developed glandular tissue than any of the other three species in this alliance and in that respect helps to tie the group into *Thelypodium* proper.

One point on which *T. tenue*, *T. Paysonii* and *T. texanum* differ from the widespread *T. Wrightii* is the shape of the style. In the latter, the style is club-shaped, whereas in the other three, the style narrows from its base to the stigmatic surface. However, all are alike in having an entire stigma that is not as great in diameter as the style. Also, all four species have spreading sepals and petals, exserted anthers and stipitate siliques.

The particularly distinctive feature of *T. tenue* is the very slender pedicels 2-3 cm. long. Actually, the lower flowers of the inflorescence are subtended by the uppermost cauline leaves, which is another distinctive characteristic.

***Sisymbrium longipes* Rollins, sp. nov.**

Biennial or possibly perennial; stems stout, up to 6 mm. in diameter, single from an unbranched caudex, glabrous, branched above, rather leafy, 7.5-15 dm. high; basal leaves unknown; cauline leaves petiolate, glabrous, blade broadly ovate to nearly oblong, entire or obscurely dentate, cuneate at base, pinnately veined but only the central vein very evident, obtuse at apex, 2-4 cm. long, 1-3 cm. wide, petiole 1-2 cm. long, slender; inflorescence dense at apex but rather delicate, greatly elongated and with individual flowers becoming more widely spaced downward, lowest separated by 4-5 cm.; sepals narrowly oblong, non-saccate, glabrous, pinkish, narrowed slightly toward base, 3-3.5 mm. long, ca. 1 mm. wide; petals spatulate, differentiated into blade and claw, claw very slender, rosy pink when dry, 3.5-4.5 mm. long, blade ca. 1.5 mm. wide; stamens tetradynamous but the single ones only about 1 mm. shorter than the paired, anthers about 1.5 mm. long; glandular tissue poorly developed into a thin but definite mold surrounding single stamens and subtending paired stamens; ovary topped by a very short (less than 0.5 mm.) style; pedicels of young siliques very slender, divaricately ascending, glabrous, 1-2 cm. long; young siliques straight, erect to somewhat spreading, apparently terete, up to 4 cm. long, less than 0.5 mm. wide; style about 1 mm. long; stigma unexpanded, not sufficiently lobed to tell whether the lobes are over the replum or not.

Herba biennis vel perennis; caulibus robustis erectis glabris 7.5-15 dm. altis superne ramosis; foliis radicalibus ignotis; foliis caulinis petiolatis glabris laminis late ovatis vel late oblongis integris obtusis 2-4 cm. longis, 1.3 cm. latis; petiolis tenuibus 1-2 cm. longis; inflorescentiis elongatis laxis; sepalis incarnatis nonsaccatis anguste oblongis glabris 3-3.5 mm. longis, ca. 1 mm. latis; petalis spathulatis incarnatis 3.5-4.5 mm. longis, ca. 1.5 mm. latis; pedicellis tenuibus divaricatis glabris 1-2 cm. longis; siliquis immaturis erectis vel divaricatis tenuibus 3-4 cm. longis, ca. 0.5 mm. latis; seminibus ignotis.

Type in the Gray Herbarium, collected above La Mina, Sierra Madre Mountains, near Monterrey, Nuevo León, Mexico, July 23, 1933, C. H. & M. T. Mueller 548. Isotype at Chicago Natural History Museum.

There is a real question as to whether this species and the next should be placed in *Sisymbrium*. Both species are related to *Sisymbrium linearifolium* (Gray) Payson, a species segregated from *Thelypodium* by Rydberg as *Hesperidanthus*. The latter genus was maintained by O. E. Schulz<sup>2</sup> as monotypic, including *H. linearifolius* alone. It was at one time placed in *Thelypodium* by Gray, but the species should not be retained there. In placing *S. longipes* in the genus *Sisymbrium*, I am following the treatment of Payson.<sup>3</sup>

The general appearance of *S. longipes*, as well as the technical characters of the flower and fruit, indicate that it should be associated with *S. linearifolium*. The buds of both species are rose to rose-pink and slightly enlarged near the middle. The flowers occur on slender pedicels that become very much elongated in fruit. This is especially true in *S. longipes*. Perhaps the most distinctive feature of the latter species is the very broad petiolate leaf. Because of its leaves, I have compared it with the Mexican species of *Iodanthus*, but it clearly does not fit in that genus. The leaves are grey-green to bluish grey and somewhat glaucous, suggesting that the plants come from an arid area.

***Sisymbrium retrofractum* Rollins, sp. nov.**

Annual or biennial; stem single from an unbranched base, branched above, glabrous, 5-8 dm. high; basal leaves not seen; caudine leaves petiolate, lanceolate to linear-lanceolate, glabrous, glaucous, 4-6 cm. long, 4-10 mm. wide, reduced upward, lower dentate to somewhat lobed, upper nearly entire, petiole ca. 1 cm. long; inflorescence lax; flowers

<sup>2</sup> Pflanzenf. 17b: 564. 1936.

<sup>3</sup> Univ. Wyo. Publ. 1: 10. 1922.

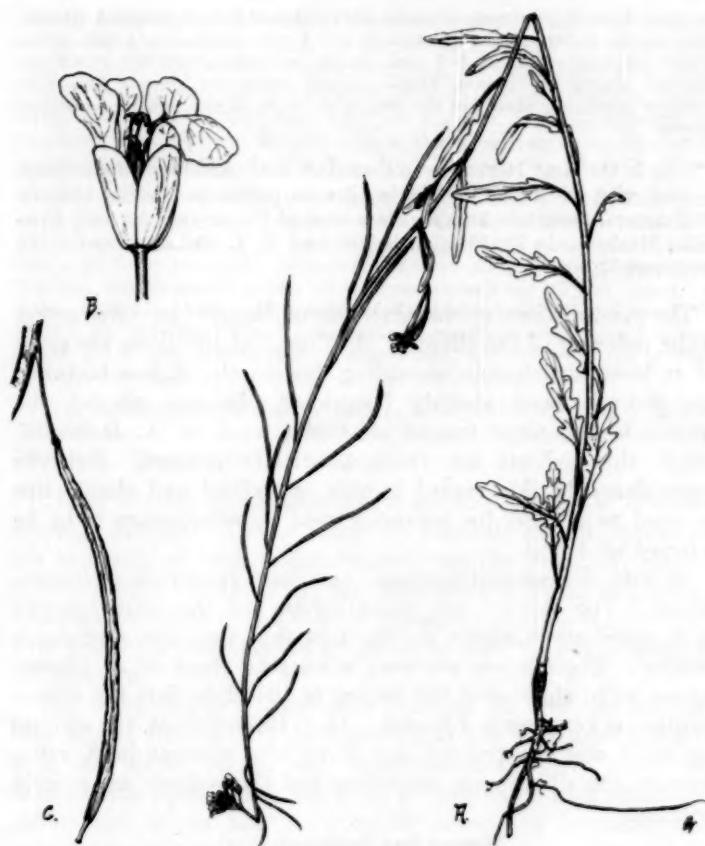


FIG. 2. *Sisymbrium retrofractum* Rollins. A—habit  $\times$  2/5. B—flower  $\times$  4. C—silique  $\times$  1-1/5. Drawings from the type by B. Tugendhat.

erect or on divariccate slender pedicels; sepals glabrous, purplish, oblong, 3.5–4 mm. long, ca. 1 mm. wide, outer pair somewhat saccate; petals spatulate with a pronounced slender claw, whitish, 6–8 mm. long; fruiting pedicels strictly reflexed, slender, glabrous, scarcely expanded at apex, 10–12 mm. long; siliques immature, narrowly linear, nearly terete, pendulous, glabrous, 4–6 cm. long, valves with single nerve almost full length; styles ca. 2 mm. long; stigmas scarcely expanded; seeds unknown. Fig. 2, A–C.

Herba annua vel biennis; caulis erectis glabris inferne simplicibus superne ramosis, 5–8 dm. altis; foliis caulinis lanceolatis vel lineari-lanceolatis

petiolatis dentatis vel sinuato-dentatis glabris glaucis 4-6 cm. longis, 4-10 mm. latis; sepalis glabris purpureis oblongis 3.5-4 mm. longis, ca. 1 mm. latis; petalis spathulatis albidis 6-8 mm. longis pedicellis fructiferis retroflexis tenuibus glabris 10-12 mm. longis; siliquis immaturis anguste linearibus teretibus pendulis glabris 4-6 cm. longis; stylis ca. 2 mm. longis; seminibus ignotis.

Type in the Gray Herbarium collected on bare sandstone outcroppings covered with low brush and herbs, flowers purple and white, altitude 2850 meters, mountain 18 kilometers west of Concepcion del Oro, Coahuila, Mexico, July 22, 1941, L. R. Stanford, K. L. Retherford and R. D. Northcraft 570.

The most distinctive characteristic of *Sisymbrium retrofractum* is the reflexing of the siliques. In flower, the pedicels are erect or at least divaricately ascending, but as the siliques matures, the pedicels bend sharply downward. In this respect the species is like some species of *Arabis*, such as *A. Holboellii*, where the pedicels are characteristically reflexed. But the resemblance in this regard is only superficial and should not be used as a basis for assuming that *S. retrofractum* is to be referred to *Arabis*.

As with *Sisymbrium longipes*, the closest relative is *S. linearifolium*. The flowers are quite similar to the latter species in *S. retrofractum* except for the fact that they are very much smaller. The siliques are very similar to those of *S. linearifolium* as to shape and the nature of the style, but the siliques position is very much different. In *S. linearifolium*, the siliques are erect and the pedicels are divaricate, whereas in *S. retrofractum*, the siliques are pendulous and the pedicels are strictly reflexed.

***Mancoa laxa* Rollins, sp. nov.**

Annual, stems highly branched from near base and above, sparsely pubescent with branched trichomes, 1-2 dm. long; basal leaves not present; caudine leaves few, sessile, pinnately lobed, with auricles at base, glabrous, 8-12 mm. long, 2-5 mm. wide, lobes oblong, entire or dentate, rounded at apex; inflorescence greatly elongated, lax, 1-1.5 dm. long, lower flowers bracteate; pedicels divaricately ascending, straight, sparsely pubescent, 3-4 mm. long; sepals oblong, glabrous, greenish, non-saccate, ca. 1.5 mm. long, < 1 mm. wide, broadly hyaline-margined; petals white, broadly spatulate, 3.5-4 mm. long, ca. 1.5 mm. wide; stamens tetrodynamic, filaments somewhat flattened, ca. 2.5 mm. long, not dilated at base, subtended by distinct lobes of glandular tissue at base on each side, anthers purple, ca. 0.75 mm. long; siliques broadly

oblong, glabrous, sessile, rounded above and below, compressed contrary to the septum, 5–6 mm. long, 2.5–3 mm. wide, individual valves boat-shaped; styles slightly less than 1 mm. long, strongly expanded at apex; replum oblong, rounded below, acute at apex; seeds numerous, brown, wingless, plump, ca. 0.75 mm. long, ca. 0.5 mm. broad; cotyledons incumbent; funiculi free, slender, about the same length as the seeds, present the full length of the replum.

Herba annua; caulinis ramosis sparse pubescentibus 1–2 dm. altis; foliis radicalibus ignotis; foliis caulinis sessilibus glabris pinnatifidis auriculatis 8–12 mm. longis, 2–5 mm. latis; inflorescentiis laxis elongatis 1–1.5 dm. longis, ad basim bracteatis; pedicellis divaricatis rectis sparse pubescentibus 3–4 mm. longis; sepalis glabris oblongis nonsaccatis ca. 1.5 mm. longis, < 1 mm. latis; petalis albis late spatulatis 3.5–4 mm. longis, ca. 1.5 mm. latis; siliquis 30–70-ovulatis late oblongis glabris sessilibus compressis 5–6 mm. longis, 2.5–3 mm. latis; stylis < 1 mm. longis; seminibus exalatis oblongis noncompressis ca. 0.75 mm. longis; cotyledonibus incumbentibus.

Type in the U. S. National Herbarium, collected on wet loam of prairie, Rosario, east of La Junta, Chihuahua, Mexico, September 14–15, 1934, *Francis W. Pennell 18767.*

Three of the seven previously known species of *Mancoa*<sup>4</sup> occur in Mexico. Two of these, *M. bracteata* and *M. mexicana*, are evidently of limited distribution, but the third, *M. pubens*, is found more widely, extending from western Texas to Chihuahua and Coahuila. The other four species are South American. The presently described new species is most closely related to *M. bracteata*.

The chief points of difference between *M. bracteata* and *M. laxa* are as follows: (1) *M. bracteata* is strict in growth-habit, with the stems, leaves and infructescences rigidly erect; *M. laxa*, on the other hand, has a lax growth-habit with somewhat decumbent stems and indifferently ascending branches and infructescences; (2) the pedicels of the former species are numerous, densely congested, at right angles to the rachis and 6–8 mm. long, whereas the pedicels of *M. laxa* are fewer, not congested, divaricately ascending and 3–4 mm. long; (3) the leaves of *M. bracteata* are more numerous, larger, and more uniformly lobed than those of *M. laxa* and the sparse pubescence is considerably coarser. All of these items taken together show a rather sharp break in the possible continuity of characteristics that should be present if we were dealing with a single species rather than two species, as is indicated by the evidence.

<sup>4</sup> Contrib. Dudley Herb. 3: 191–196. 1941.

**Cibotarium microcarpum** Rollins, sp. nov.

Perennial with a suffruticose base, caudex branched once or twice, remnants of old leaf-bases present; stems terete, branched above, densely pubescent with dendritically branched trichomes, 1.5-3 dm. high; leaves all similar, overlapping, reduced in size upward, petiolate, spatulate to oblanceolate, obtuse, shallowly dentate, somewhat sinuate, densely pubescent with dendritically branched trichomes, with a single prominent nerve below, 1-4 cm. long, 2-5 mm. wide; inflorescences terminating the branches, ca. 1 dm. long; pedicels slender, straight, divaricately spreading at ca. 60° angle from rachis, 3-4 mm. long; sepals greenish with a hyaline margin, oblong, sparsely pubescent, spreading at anthesis, less than 1 mm. long, ca. 0.5 mm. wide; petals minute, white, narrowly spatulate, shorter than sepals, ca. 0.75 mm. long, ca. 0.1 mm. wide; stamens exserted, spreading filaments equal or nearly so, 1.25-1.5 mm. long; anthers purplish or yellowish, oval, ca. 0.1 mm. long; pollen oblong,  $23.3 \times 12.6 \mu$  (ave. 10 grains); siliques slightly oblong to nearly orbicular, not flattened, densely pubescent on the exterior, glabrous within, 1.5-2.5 mm. long, 1.25-1.5 mm. broad, stipitate; stipe ca. 0.2 mm. long; valves not nerved; styles slender, ca. 1 mm. long; seeds 4-6 in each loculus, oblong, wingless.

Herba perennis suffruticosa; caulis teretibus ramosis pubescentibus 1.5-3 dm. altis; foliis petiolatis spatulatis vel oblanceolatis obtusis denticulatis dense pubescentibus infra 1-nervatis 1-4 cm. longis, 2-5 mm. latis; pedicellis tenuibus divaricatis rectis pubescentibus 3-4 mm. longis; sepalis oblongis nonsaccatis < 1 mm. longis; petalis albis minutis anguste spatulatis ca. 0.75 mm. longis, ca. 0.1 mm. latis; siliculis stipitatis, oblongis vel globosis noncompressis pubescentibus 1.5-2.5 mm. longis, 1.25-1.5 mm. latis; stylis tenuibus ca. 1 mm. longis; seminibus oblongis immarginatis.

Type in the Gray Herbarium, collected on the dry rocky calcareous slopes of Barranca de Tolimán somewhat above the mines, 7.6 miles from Zimapán on road to Mina Loma del Toro and Balcones, District of Zimapán, Hidalgo, Mexico, October 30, 1949, H. E. Moore, Jr. 5443. Isotype at the Bailey Hortorium.

The siliques of this species are definitely stipitate although the stipe is very short. There is a slight tendency towards compression of the siliques contrary to the septum but this is not at all marked. There is no suggestion of a notch at the apex. Instead, the valves tend to project toward the style to a minor degree. The siliques are nearest in size to those of *C. stellatum*, but they are neither notched nor compressed and the style is considerably longer than in that species. The petals, though very small, are not quite as abbreviated as in *C. stellatum*. In general aspect, *C. microcarpum* resembles *C. fruticosum*,

but again, the fruits are neither compressed nor notched as in that species and the styles are considerably longer.

*Cibotarium* is one of the few genera in the *Cruciferae* where in some species an indument occurs on the interior of the siliques. No explanation of this rather remarkable phenomenon has been attempted, but a careful study of it might be rewarding for the light it would shed on the carpel situation in the crucifer fruit. So far, in this genus I have observed trichomes on the interior of the siliques of *C. divaricatum*, *C. macropetalum* and *C. macrum*.

The discovery of another new species of *Cibotarium* emphasizes the fact that the species of it are extremely local in their occurrence, often with only scattered individuals to be found. Furthermore, the need for much more exploration in the arid areas of northeastern and north central Mexico is clearly demonstrated.

***Rorippa microtis* (Robins.) Rollins, comb. nov.**

*Sisymbrium microtites* Robinson, Bot. Gaz. **30**: 59. 1900.

*Nasturtium microtites* (Robins.) O. E. Schulz, Rep. Spec. Nov. **34**: 134. 1933.

Mexico.—Chihuahua: 5 miles southeast of Colonia Garcia, Sierra Madre, 23 June 1897, *C. H. T. Townsend* and *C. M. Barber* 43 (GH-type; F-isotype); shallow ditch, open pineland, Llanura de Babicora, Sierra Madre Occidental, 19 Sept. 1934, *F. W. Pennell* 19019 (US); Majalca, 24 June 1936, *Harde Le Sueur* 1210 (F, GH); same locality, 25 June 1936, *Le Sueur* 640 (GH); Rio Chico, 5 Aug. 1937, *Le Sueur* 1325 (GH).

With considerably more material than was available to Robinson, in all stages of development, it is perfectly evident, as it was to O. E. Schulz (l.c.), that this species is not a *Sisymbrium* but is to be associated with plants now placed in the genus *Rorippa*. Schulz had a somewhat different conception of *Nasturtium* than is generally held at present and this accounts for his having placed *Rorippa microtis* in that genus.—GRAY HERBARIUM, HARVARD.

A NEW TRIDENS RECORD FROM MISSOURI.—The finding of *Tridens oklahomensis* (Feath.) Feath. in Missouri is the second reported occurrence of this species anywhere. Originally described from Oklahoma by Featherly,<sup>1</sup> *T. oklahomensis* was found in September, 1955 near Columbia, Missouri, T 48N, R 13W, sect. 3. Plants occurred in moist soil, with *T. strictus* and *T. flavus*. In general appearance *Tridens oklahomensis* resembles the latter; however, the panicles are more compact with the branches being floriferous for a greater proportion of their total length. The spikelets, which disarticulate early in *T. flavus*, remain intact through the winter on *T. oklahomensis*, thus exhibiting a feature typical of *T. strictus*. This new grass species has since been found in two more widely separated stations in which the two other *Tridens* also occurred. The pattern of distribution may be significant, and together with intermediate panicle characters found in *T. oklahomensis* suggests the possibility of a hybrid origin. Information concerning the Oklahoma species supplied by Dr. Featherly does not exclude this possibility. Furthermore, no location in Missouri has been found to date having two species present without the third. The examination of a great number of spikelets indicates that *T. oklahomensis* in Missouri is probably sterile. Additional study is needed to better interpret the distributional relationship of the three species, and perhaps determine the origin of *T. oklahomensis*. Appreciation is expressed for verifying the identity of Missouri material by Dr. Swallen. The author wishes to thank Dr. Featherly for his personal communications and for the loan of Oklahoma material. Deposits of Missouri specimens have been made in the University of Missouri herbarium. Specimens have also been sent to the National Herbarium.—C. L. KUCERA,  
DEPARTMENT OF BOTANY, UNIVERSITY OF MISSOURI.

<sup>1</sup> FEATHERLY, H. I. A New *Triodia* from Oklahoma. *RHODORA* 46: 1938.

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